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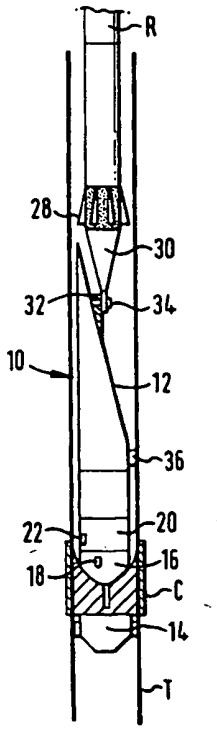
(54) Title: A SYSTEM AND METHOD FOR LOCATING A TOOL IN A WELLBORE, A TUBULAR AND A DEVICE FOR THE SYSTEM

(57) Abstract

A system for locating a tool in a wellbore, said system comprising a profile (M) disposed in a tubular (T, C) such as casing or a coupling and a device (99) for engaging said profile (M), wherein, in use said device (99) locates or engages said profile (M) and is held in relation therewith, said device (99) being connectable or integral with a tool (12, 24). A Tubular (T, C) for the system for locating a tool in a wellbore. A device (99) for the system for locating a tool in a wellbore. A method for locating a tool in a wellbore using the system, the method comprising the step of lowering said device in a wellbore and engaging said profile, whereupon a tool is located.



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A system and method for locating a tool in a wellbore, a tubular and a device for the system

The present invention relates to a system and method for locating a tool in a wellbore, a tubular and a device of the system, and particularly but not exclusively, to a system for locating a whipstock in a string of casing.

In the construction of an oil or gas well, it is often necessary to locate a tool in a wellbore. A particular example is in the positioning of a whipstock in a string of casing in the construction of multi-lateral or horizontal wells.

Prior to the present invention, whipstocks were lowered on a tool string or wireline. The whipstock was anchored in place using pads activated by a trip bar. Correct positioning and orientation is difficult to achieve. It is important that an anchor be activated only at a desired location in the string of casing and that an anchor not be activated prematurely.

According to the present invention there is provided a system for locating a tool in a wellbore, said system comprising a profile disposed in a tubular such as casing or a coupling and a device for engaging said profile, wherein, in use said device locates or engages said profile and is held in relation therewith, said device being connectable or integral with a tool.

Preferably, said tubular has an inner diameter and the profile is positioned beyond said inner diameter so that the profile does not project into said tubular. This can be achieved by milling a profile from the inside wall of a section of tubular or casing. Alternatively, a coupling may be manufactured to a high tolerance and used in a string of tubulars or casing, thereby inhibiting structural weaknesses in the string. Alternatively, the coupling could be made from an alternative material such as carbon fibre, high grade steel alloys or a zinc alloy.

Tubular members or couplings may have slots or profiles that are configured, sized, and disposed so that the slots or profiles do not block or intrude therein. The profile may be a projection such as a lug.

Advantageously, said profile comprises a slot for receiving a key of said device. The profile my comprise a muleshoe slot with upper tapered portions on either side of a lower slot portion, the upper tapered portions for guiding the lug down into the lower slot portion. The key is movable into the slot thus indicating that an item, e.g. but not limited to a whipstock, is oriented in a particular known position when the location of the slot with respect to the earth's surface and when the orientation of the slot radially with respect to the wellbore is known.

Preferably, said key is biased outwardly from said device.

Advantageously, said key is initially retained by a sleeve.

Preferably, said sleeve comprises friction engaging means which engage said tubular, such that upon a predetermined movement of said device relative to said tubular, said key is released.

Advantageously, the friction engaging means engage said tubular isolating the profile from weight of the system.

Preferably, said sleeve comprises a slot, such that, in use said key is released therethrough upon alignment therewith.

Advantageously, one of said device and said sleeve comprises a pin and the other of said device and said sleeve comprises an indexing channel, such that upon said predetermined movement of said device relative to said tubular, said pin follows said indexing channel to align said slot with said key.

Preferably, the system further comprising a second key.

Advantageously, said second key is biased outwardly from said device.

Preferably, said device comprises a body with a rotatable member arranged therein, said key arranged on said rotatable member and projects through a window in body.

Advantageously, said rotatable member is shear pinned to said body.

Preferably, said device comprises a second rotatable member arranged in said body, said second key arranged on said second rotatable member and projects through a window in said body.

Advantageously, said second rotatable member is shear pinned to said body.

Preferably, a second slot is provided in said sleeve such that when said second key is aligned therewith said second key projects therethrough. In use, the first and second keys follow the profile.

Advantageously, said first slot is radially offset from and positioned below said second slot. The key offset feature, and thus the sequential key movement into the slot, provides a fail-safe feature that prevents actuation of a setting mechanism until correct orientation has been achieved.

Preferably, said first slot is wider than said second slot so that said first key is movable to contact said profile and move downwardly therein prior to the second key contacting said profile.

Advantageously, said second member is disposed above said first member.

Preferably, alignment of said second key with said profile activates an activating member. The first key locates in the profile to obtain a known orientation. The

second key locates in the profile which releases or activates a setting mechanism to lock a tool to the string of tubulars.

Advantageously, said activating member activates a setting mechanism.

Preferably, said activating member is releasably secured to said setting mechanism by a shear member, following release said activating member is movable to contact said second member so that force of the said activating member against the second member shears the shear member.

Advantageously, the keys and their respective members are disposed so that the activating member is movable to contact said second tubular member only after the second key contacts said profile.

Preferably, the system further comprising a concave.

Advantageously, the system further comprises a mill releasably connected to said concave.

Preferably, the system further comprises a tubular string to which the mill is connected.

Advantageously, the system further comprises a flexible member connected between said device and said tool. The flexible member, flexible pipe, flexible joint or flexible coupling is used in the system to accommodate bending or flexing thereof; in one aspect, such a flexible item is disposed between the setting mechanism and the wellbore locator system.

Preferably, the tubular supports the weight of the system.

The present invention also provides a tubular for the system for locating a tool in a wellbore. The tubular may be a coupling, casing or pipe. Several profiles arranged in or on casing or couplings may be disposed in the wellbore.

The present invention also provides a device for the

system for locating a tool in a wellbore.

The present invention also provides a method for locating a tool in a wellbore using the system, the method comprising the step of lowering said device in a wellbore and engaging said profile, whereupon a tool is located.

For a better understanding of the invention reference will now be made, by way of example to the accompanying drawings.

Fig. 1A is a side cross-sectional view of a coupling according to the present invention in a tubular string; Fig. 1B is a cross-sectional view along line 1B-1B of Fig. 1A;

Fig. 2A to 2F are schematic side views partly in cross-section of steps in the operation of a system according to the present invention;

Fig. 3A to 3F are cross-sectional side views of steps in the operation of a system according to the present invention; Fig. 3G is an enlargement of Fig. 3A;

Fig. 4A is a side view partly in cross-section of a coupling according to the present invention; Fig. 4B is a side view in cross-section of a coupling according to the present invention;

Fig. 5A is a side view partly in cross-section of a sleeve of the system of Fig. 3A; Fig. 5B is a cross-sectional view taken along line 5B-5B of Fig. 5A; Fig. 5C is a cross-sectional view taken along line 5C-5C of Fig. 5A; Fig. 5D is an outer side view of part of the sleeve of Fig. 5A;

Fig. 6 is a side view partly in cross section of a body of the system of Fig. 3A;

Fig. 7A is a side view half in cross-section of an orientation adapter of the system of Fig. 3A; Fig. 7B is a cross-section view along line 7B-7B of Fig. 7A; Fig. 7C is a cross-section view of the orientation adapter of Fig. 7A;

Fig. 8A is a side cross-sectional view of a spline nut of the system of Fig. 3A; Fig. 8B is a side cross-sectional view of part of the spline nut of Fig. 8A;

Fig. 9 is a side view of an first, lower tubular member for housing a first extendable key of the system

of Fig. 3A;

Fig. 10A is a side view of a second, upper tubular member for housing a second extendable key of the system of Fig. 3A; Fig. 10B is a side cross-sectional view of the tubular member of Fig. 10A; Fig. 10C is a side cross-sectional view of the key of the tubular member of Fig. 10A; Figs. 10D and 10E are perspective views of the key of Fig. 10C;

Fig. 11A is a top cross-sectional view of the sleeve of Fig. 5A; Fig. 11B is a top cross-sectional view that shows the sleeve of Fig. 11A encompassing a key in a tubular member (as in Fig. 9 or Fig. 10A); Fig. 11C shows the sleeve of Fig. 11B moved to permit the key to move outwardly from the tubular member.

Referring now to Figs. 1A and 1B, a wellbore tubular string S disposed in an earth wellbore W has a plurality of couplings C interconnecting tubulars T of the string S. Each coupling C has a mule shoe profile M and slot L which, as shown in Fig. 1B do not project further inwardly than the inner diameter D of the tubulars T. Each coupling C is at a known location in the wellbore W. This location may be determined using known devices and methods. The couplings, and therefore their respective slots, may be disposed with any orientation. The orientation of a slot in a particular coupling may be determined with known techniques and devices.

Figs. 2A to 2F show schematically a system 10 according to the present invention approaching with a whipstock 12, friction device 14, first tubular member 16 with first lower key 18, second tubular member 20 with second upper key 22, and setting mechanism 24 with slips 26. Optionally, a mill system 28 is used attached to a tubular string R (shown in Fig. 2A) with at least one mill, including but not limited to, a starting mill 30 releasably secured to a lug 32 of the whipstock 12 with a

shear stud 34.

Fig. 2A shows the system 10 approaching one of the couplings C. The friction device 14 has engaged an inner wall of a tubular T so that an inner portion of the system that includes the tubular members 16 and 20 can be lifted with respect to an outer sleeve (not shown; described with respect to the embodiment of Fig. 3A, below). The outer sleeve is attached to the friction device 14. As shown in Fig. 2A neither key has yet contacted the muleshoe profile M of the coupling C. The coupling C does not support the weight of the system 10 and the system is not fixed to the coupling C. The tubular T is part of a string disposed in a wellbore like the wellbore W (Fig. 1A).

As shown in Fig. 2B, the inner portion of the system 10 has been lifted and rotated so that the first lower key 18 is released to project through a window in the outer sleeve (as described below) to engage the muleshoe profile M and move down in the slot L, thus assuring correct orientation of the whipstock 12.

Referring now to Fig. 2C, the second upper key 22 has projected through a corresponding sleeve window (not shown) and moved down in the slot L. The alignment of the upper and lower keys followed by additional downward movement of the keys in the slot permits setting of the slips 26. The lower key 18, its rotatable member 16 along with the upper key 22 and its rotatable member 20 do not move down further once in the bottom of the slot L. Inner parts of the system move down so that the trip bar contacts the upper key's tubular member 20 shearing a roll pin (as described below) and effecting setting of the slips 26. Tripping of the setting mechanism 24 also moves the whipstock 12 on a fulcrum slip 36. The second upper key 22 is positioned as is the second tubular member 20 so that such setting cannot occur until the

second upper key has moved down to the muleshoe profile. Thus premature whipstock setting is prevented and whipstock setting occurs only following correct orientation of the whipstock by the action of the first lower key 18. To prevent the slot L, the muleshoe profile M, and the coupling C from bearing the weight of the system and force thereon, overtravel is provided for with an extension of an upper window in a tool body through which the upper key projects and an extension of a control slot in an outer sleeve – all as described below in detail, e.g. with respect to Figs. 3A - 3F; i.e. the windows and slot extension prevent system lock-up.

It is within the scope of this invention to use any known suitable whipstock with any known suitable whipstock setting device, mechanism, or apparatus and/or packer or anchor packer.

Fig. 2D shows a window 38 milled through the tubular T (e.g. but not limited to casing) using any known mill or milling system diverted by the whipstock 12 and a lateral or sidetracked bore 40 created with any known device or system useful for making such a bore. Fig. 2E shows the completed bore 40 and the whipstock 12 removed from the tubulars T. It may be removed by any suitable known removal device or system and/or it may be milled out. Passage and/or flow through the tubulars T is now possible again.

Fig. 2F shows a diverter whipstock 50 installed in the tubulars T of Fig. 2E. The diverter whipstock 50 provides a diverter device for subsequent operations in the bore 40, including, but not limited to, e.g. further drilling with a drill system 52 to extend and/or re-direct the bore 40. The diverter whipstock may employ a single key (not shown) to achieve correct orientation and setting; or, alternatively, it may have a set of keys 54, 56 (like the keys 18, 22 described above) and related

apparatus, as described above, for whipstock orientation and setting. Alternatively, the whipstock 12 may be left in place for further operations.

Fig. 4A and 4B show a coupling 60 (one possible embodiment of a coupling C as in Fig. 1A) with an upper end 61 having inner tapered surfaces 62 and 63, a lower end 67 with an inner tapered surface 68 for facilitating movement of the keys 18 and 22 and other wellbore apparatuses therethrough. An inner muleshoe profile 64 with a slot 65 is formed in a wall 66 of the coupling 60. Figs. 3A - 3F show a sequence of steps in the operation of a system 100 according to the present invention which can be used as the system 10 in Figs. 2A - 2D. The system 100 has a friction mechanism 102 with a plurality (one or more, four in the system 100) of spring-loaded blocks 104 constantly urged outwardly by springs 106 from recesses 108 in a body 110. The outer surfaces of the blocks 104 may be wholly coated with hardfacing material or intermittently striped therewith. A lower end 112 of the body 110 has a tapered nose 114 for ease of movement through tubulars of a tubular string. A collar 113 threadedly mated with the nose 114 holds the blocks 104 in place.

An outer sleeve 120 is movably disposed around and encircles a first tubular member 124, a second tubular member 122 and a third tubular member 123. The two tubular members 122 and 124 are not interconnected and the upper one rests on the lower one. The third tubular member 123 is welded to a tool body 125. A lug 126 projects outwardly from the third tubular member 123 into a slot 130 through the outer sleeve 120. A first key 128 is initially held by the inner surface (shown cutaway in Fig. 3A) of the outer sleeve 120 in a recess 132 in the first tubular member 124 and in a window 135 in the tool body 125. A second key 134 is initially held in a recess

136 in the second tubular member 122 by the inner surface of the outer sleeve 120. The keys are extendable through a window 137 in the tool body 125. Springs as the springs 143 in key recesses 145 and body recesses 147 (Fig. 10B) urge the keys outwardly. A screw or bolt 151 extending through the tubular member (122 or 124) projects into a recess 153 in the key and prevents the key from exiting completely from its tubular member.

A trip bar 200 disposed above a top of the second tubular 122 is interconnected with a whipstock setting mechanism and a whipstock (shown schematically as SM and WS respectively in Fig. 3A). The whipstock WS is releasably attached to a mill M which is connected to a tubular string TS (both shown schematically in Fig. 3A). The string TS extends to the earth surface from a wellbore WL in which the system 100 is to be set. Such a trip bar, setting mechanism, and whipstock are well known in the art (e.g., but not limited to, Weatherford's commercially available "WHIPBACK" whipstock).

The tubular members 122, 123, and 124 are enclosed in the tool body 125. The tubular member 124 is sandwiched between the tubular members 122 and 124 within the tool body 125, but in one aspect, is connected to neither. The third tubular member 123 rests on the body 110 so that lifting the tool body 125 lifts the three tubular members. The trip bar 200 extends through an orientation adapter 202 and is releasably shear pinned thereto with a roll pin 203 that extends through the adapter 202 and into the trip bar 200. The trip bar 200 is movable downwardly once the roll pin is sheared by moving the string is downwardly to contact the top of the second tubular member 122.

A device inserted into the well bore is generally identified by reference numeral 99 (Fig. 3G)

Fig. 3A illustrates the system 100 while it is being

run through a string of casing 152 in the wellbore WL.. Neither key yet projects through its window in the outer sleeve 120. A spline nut 211 secures the tool body 125 to the orientation adapter 202. A pin 207 (see Fig. 3C) releasably holds the upper tubular member 122 to the tool body 125 (pin 207 sheared in Fig. 3E). An upper tubular 219 is connected to the adapter 202. In the remaining figures 3B - 3F, the wellbore, casing, tubular string, mill, and whipstock are not shown but are understood to be present as in Fig. 3A.

Fig. 3B illustrates the system 100 at a desired location in the wellbore with respect to a coupling 209 (shown schematically only, e.g. like the couplings in Fig. 1A) in the casing string 152 at a known location (e.g. as in Fig. 1A and 2A). At this point the friction blocks 104 sufficiently engage the casing 152. By lifting up on the tubular string TS, all of the following items are moved upwardly with respect to the friction mechanism 102 and the outer sleeve 120 (both of which remain stationary within the casing as the lifting occurs): mill M, whipstock WS, whipstock setting mechanism SM, trip bar 200 (releasably held to the adapter 202 by a roll pin 203 extending through bores 205 in the adapter 202 - see Fig. 7B), orientation adapter 202, spline nut 211, tool body 125, and tubular members 122, 123, and 124. As these items are lifted, the keys 128 and 134 ride up within the interior of the outer sleeve 120 and the lug 126 moves from the position shown in Fig. 3A in the slot 130 to the position shown in Fig. 3B.

As shown in Fig. 3C the inner parts that were lifted as shown in Fig. 3B are turned to the right by turning the tubular string TS. The outer sleeve 120 remains immobile and the keys 128 and 134 move to a position above their respective windows 160 and 135 respectively

in the outer sleeve 120. The lug 126 has moved from the position of Fig. 3B to that of Fig. 3C (i.e. to the left in the figure).

As shown in Fig. 3D, the tubular string TS has been moved down, which moves the keys 128 and 134 down so that they are urged outwardly by their respective springs through the windows 160 and 135, respectively. The downward movement of the tubular string is governed by the downward movement of the lug 126 in the slot 130 from the position shown in Fig. 3C to that of Fig. 3D. Preferably the two keys are urged simultaneously through their respective windows and that the windows are offset so that sequential engagement of the muleshoe slot of the coupling 209 is effected; i.e., in this embodiment, both keys can only project simultaneously. However, in other embodiments of the invention, other window dispositions are envisaged so that sequential outward projection of the keys is possible.

In the position of Fig. 3D the keys 128 and 134 lock the outer sleeve 120 (and therefore the friction mechanism 102) to the rest of the system 100 so that movement of the tubular string with sufficient force moves the entire system 100. Thus, as shown in Fig. 3E, the entire system is moved down so that the key 128 contacts and moves down in the muleshoe slot 130 of the coupling 209. This force breaks the pin 207 (i.e. when the lower key 128 is down in the slot 130 and the upper key 134 has contacted the upper lip of the muleshoe slot). In one aspect, this force also shears the roll pin 203. In another aspect, the roll pin 203 is set to shear at a force (e.g. but not limited to 4500 pounds, 1000 pounds or greater) that is greater than that at which the pin 207 shears (e.g. but not limited to at about 4400 pounds).

As shown in Fig. 3E, the keys 128 and 134 are

radially (one-above-the other) aligned and the lug 126 has moved to the position shown in the slot 130. Due to an extended upper part 213 of the window 135 in the tool body 125 and a lower portion 141 of the slot 130, downward movement of the tubular string and the parts connected thereto results in shearing of the roll pin 203 (if not already sheared) so that the trip bar 200 moves down (as shown in Fig. 3F) to abut a top 143 of the upper tubular member 122, beginning the setting sequence for setting of slips (not shown) which are part of the setting mechanism SM. As the trip bar 200 moves down, the keys 128, 134 are locked into the outer sleeve 120 and are also bottomed out in the slot of the coupling 209 (i.e., the keys and outer sleeve are now held immobile). Also the friction mechanism 102 which is threadedly secured to the outer sleeve 120 is mobile.

Figs. 7A - 7C shown the orientation adapter 202. The adapter 202 has a spline portion 233 that is movable within a portion 219 of the spline nut 211 (see Fig. 8A) when the spline portion 233 is disposed adjacent the portion 219. Threads 204 on the adapter 202 mate with threads 213 of the spline nut 211 and threads 212 of the spline nut 211 mate with exterior threads 159 of the tool body 125. By appropriate positioning of the spline nut 211 with respect to the spline portion 233 of the adapter 202, the adapter 202 is free to rotate so that an item thereabove (e.g. but not limited to a whipstock) can be rotated to achieve a desired orientation. Following correct positioning of the item, the spline nut is again tightened to maintain the correct position of the item; e.g. so that a whipstock is oriented within a wellbore so that a mill will be directed by the whipstock to mill at a desired location of a tubular or so that a drill will drill away from the whipstock at a desired angle. Upon tightening of the spline nut 211, the spline portion 233

of the adapter 202 engages an inner spline portion 157 of the tool body 125. Different pitches on the threads 212 and 213 provide for desired manipulation of the adapter 202 and spline nut 211. For adequate adjustability, in one aspect, the spline portion 203 has a height about half that of the portion 219.

Figs. 8A and 8B show the spline nut 211 that connects the orientation adapter 202 and the tool body 125. A bore 214 extends through the spline nut from top to bottom.

Fig. 9 shows the upper tubular member 122 with its key 134. A hole 139 is provided for a bolt (not shown, like the bolt 151, Fig. 10A); and a hole 127 is provided for receiving part of the shear pin 207.

Figs. 10A - 10B show the tubular member 124 with its key 128 and a bolt 151 holding the key 128 movably in its recess 132. As shown in Figs. 10B and 10C, springs 143 in key recesses 145 and body recesses 143 urge the key 128 outwardly. The 134 (Fig. 9) has similar structure and springs. A bevelled edge 149 facilitates upward movement of the system when the key is projecting from the tool body. A shown in Figs. 10D - 10E a key may have a bevelled edge 149 and a tapered end 155 to facilitate key action and movement. It is within the scope of this invention to use: non-bevelled keys without an end 155; keys with both ends bevelled as at 149 or with both ends like the end 155; and/or a key with either end bevelled as at 149 or with either end like the end 155.

Figs. 11A - 11C show the outer sleeve 120 and its relation to the key 134 - which is similar to the relation to the key 128. Initially the outer sleeve 120 prevents the keys from projecting outwardly past the outer sleeve 120 (Fig. 11B). With proper system movement, the key 134 is aligned with the window 135 and moves through it (Fig. 11C).

Figs. 12A and 12B shown alternative embodiments of the system 100. In the system 100a of Fig. 12A the orientation adapter 202 is deleted and the trip bar 200 extends through a flexible item, e.g. a flexible coupling 240. In one aspect the flexible coupling 240 is a Powertork (TM) Series F or S gear coupling as is commercially available from Systems Components, Inc. of South Haven, Michigan; however, any suitable flexible item or member may be used in place of the coupling 240 to accommodate bending and/or flexing of the system, including but not limited to a bendable piece of pine, drill pipe, or drill collar.

Fig. 12B shows a system 100b which is like the system 100, but with the addition of a flexible coupling 240 (or flexible item or member as discussed above).

Claims

1. A system for locating a tool in a wellbore, said system comprising a profile (M) disposed in a tubular (T,C) such as casing or a coupling and a device (99) for engaging said profile (M), wherein, in use said device (99) locates or engages said profile (M) and is held in relation therewith, said device (99) being connectable or integral with a tool (12,24).

2. A system as claimed in Claim 1, wherein said tubular (T,C) has an inner diameter and the profile (M) is positioned beyond said inner diameter so that the profile does not project into said tubular (T,C).

3. A system as claimed in Claim 1 or 2, wherein said profile (M) comprises a slot (L) for receiving a key (18) of said device (99).

4. A system as claimed in Claim 3, wherein said key (18) is biased outwardly from said device (99).

5. A system as claimed in Claim 4, wherein said key (18) is initially retained by a sleeve (120).

6. A system as claimed in Claim 5, wherein said sleeve (120) comprises friction engaging means (104) which engage said tubular (T,C), such that upon a predetermined movement of said device (99) relative to said tubular (T,C), said key (18) is released.

7. A system as claimed in Claim 6, wherein the friction engaging means (104) engage said tubular isolating the profile (M) from weight of the system.

8. A system as claimed in Claim 5, 6 or 7, wherein said sleeve (120) comprises a slot (135), such that, in use said key (18) is released therethrough upon alignment therewith.

9. A system as claimed in Claim 5, 6 or 7, wherein one of said device (99) and said sleeve (120) comprises a pin (126) and the other of said device (99) and said sleeve (120) comprises an indexing channel (130), such that upon

said predetermined movement of said device (99) relative to said tubular (T,C), said pin (126) follows said indexing channel (130) to align said slot (135) with said key (18).

10. A system as claimed in any preceding claim, further comprising a second key (22).

11. A system as claimed in Claim 12, wherein said second key (22) is biased outwardly from said device (99).

12. A system as claimed in any of Claims 3 to 11, wherein said device (99) comprises a body (125) with a rotatable member (124) arranged therein, said key (18) arranged on said rotatable member (124) and projects through a window (137) in body (125).

13. A system as claimed in Claim 12, wherein said rotatable member (124) is shear pinned to said body (125).

14. A system as claimed in Claim 12 or 13 when appended to claim 10 or 11, wherein said device (99) comprises a second rotatable member (122) arranged in said body (125), said second key (22) arranged on said second rotatable member (124) and projects through a window (137) in said body (125).

15. A system as claimed in Claim 14, wherein said second rotatable member (122) is shear pinned to said body (125).

16. A system as claimed in Claim 14 or 15, wherein a second slot (60) is provided in said sleeve (120) such that when said second key is aligned therewith said second key (22) projects therethrough.

17. A system as claimed in Claim 16, wherein said first slot (135) is radially offset from and positioned below said second slot (60).

18. A system as claimed in Claim 16 or 17, wherein said first slot (135) is wider than said second slot (60) so that said first key (18) is movable to contact said

profile (M) and move downwardly therein prior to the second key (22) contacting said profile (M).

19. A system as claimed in any of Claims 14 to 18, wherein said second member (122) is disposed above said first member (124).

20. A system as claimed in any of Claims 14 to 19, wherein alignment of said second key (22) with said profile (M) activates an activating member (200).

21. A system as claimed in Claim 20, wherein said activating member (200) activates a setting mechanism (24).

22. A system as claimed in Claim 21, wherein said activating member (200) is releasably secured to said setting mechanism (24) by a shear member (203), following release said activating member (200) is movable to contact said second member (124) so that force of the said activating member (200) against the second member (124) shears the shear member (203).

23. A system as claimed in Claim 22, wherein the keys (18,22) and their respective members (124,122) are disposed so that the activating member (200) is movable to contact said second tubular member (122) only after the second key (22) contacts said profile (M).

24. A system as claimed in any preceding claim further comprising a concave (12).

25. A system as claimed in Claim 24, further comprising a mill (28) releasably connected to said concave (12).

26. A system as claimed in Claim 25, further comprising a tubular string to which the mill (28) is connected.

27. A system as claimed in any preceding claim, further comprising a flexible member (240) connected between said device and said tool.

28. A system as claimed in any preceding claim, wherein the tubular supports the weight of the system.

29. A tubular for the system as claimed in any preceding

claim.

30. A device for the system as claimed in any preceding claim.

31. A method of locating a tool in a wellbore using the system as claimed in any of Claims 1 to 28, the method comprising the step of lowering said device in a wellbore and engaging said profile, whereupon a tool is located.

FIG. 1A

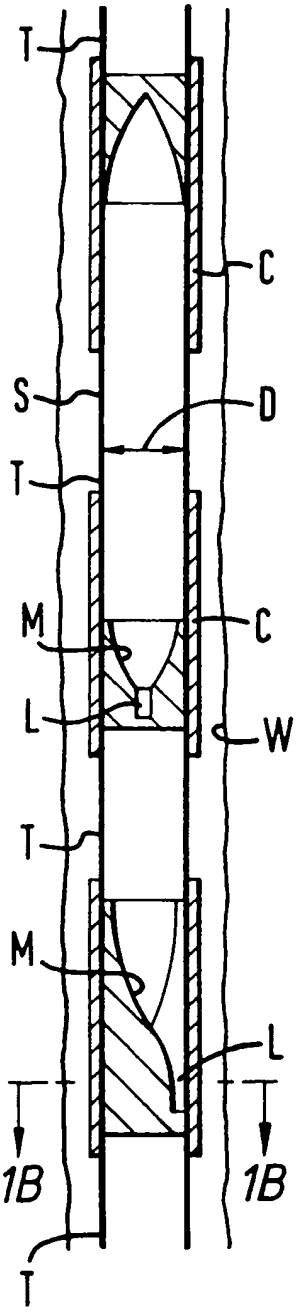


FIG. 2A

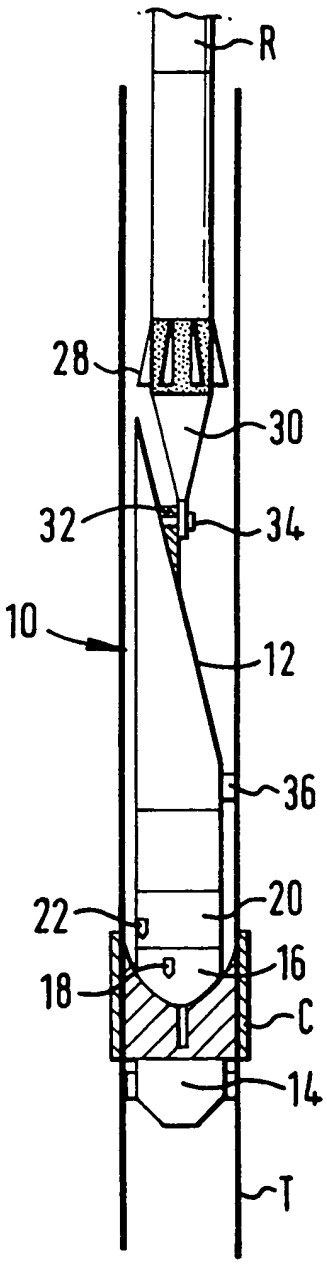
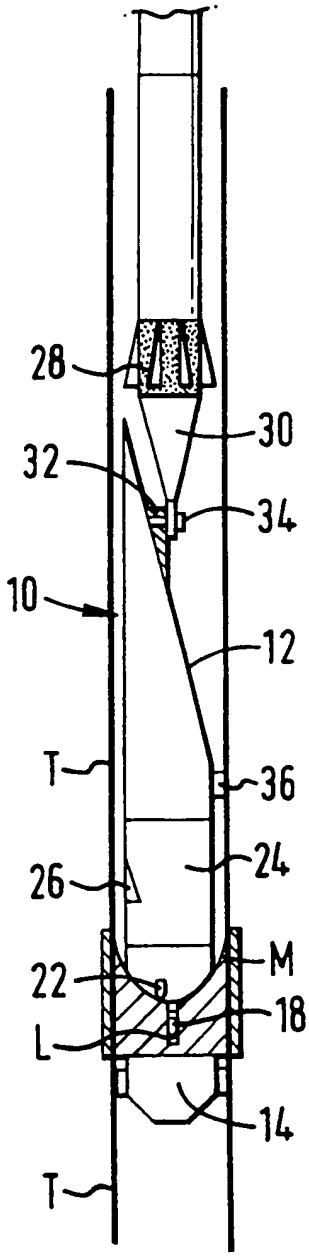


FIG. 2B



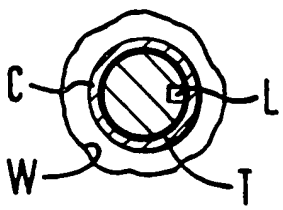


FIG. 1B

FIG. 2C

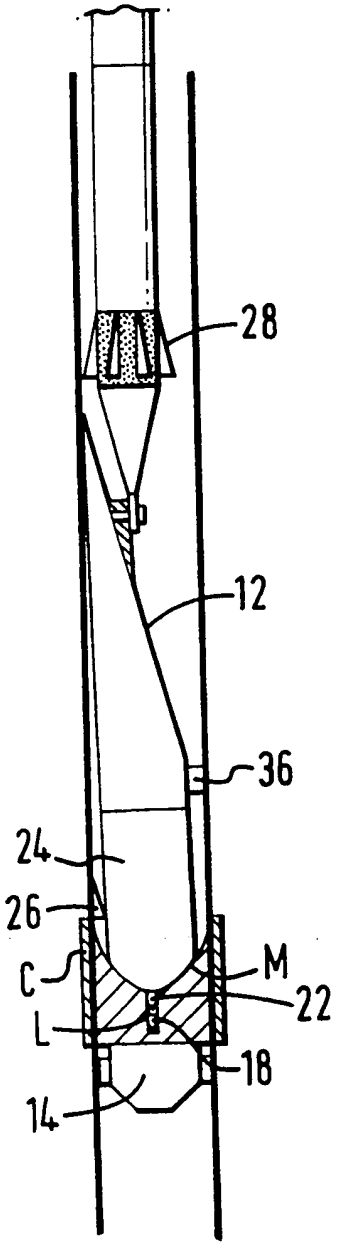


FIG. 2D

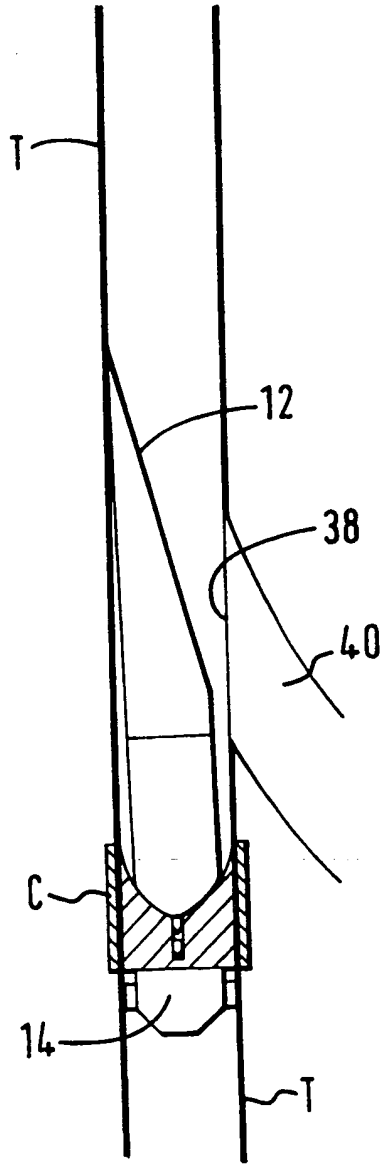


FIG. 2E

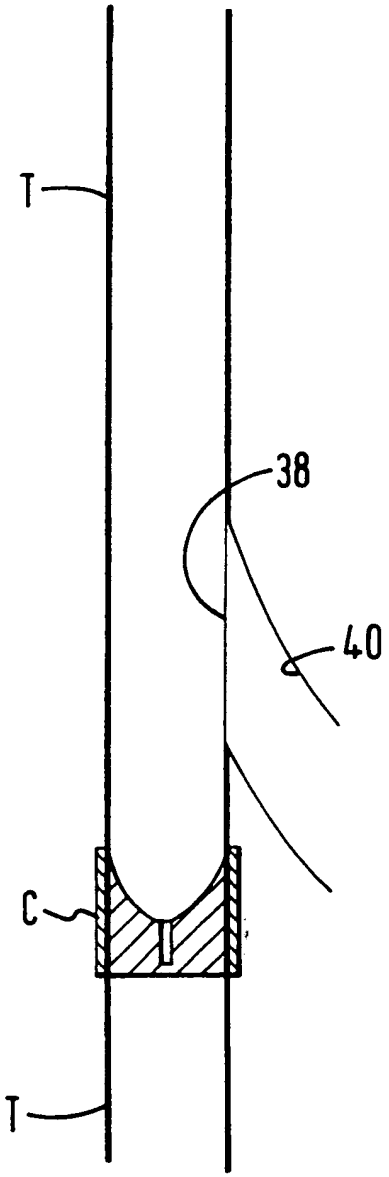
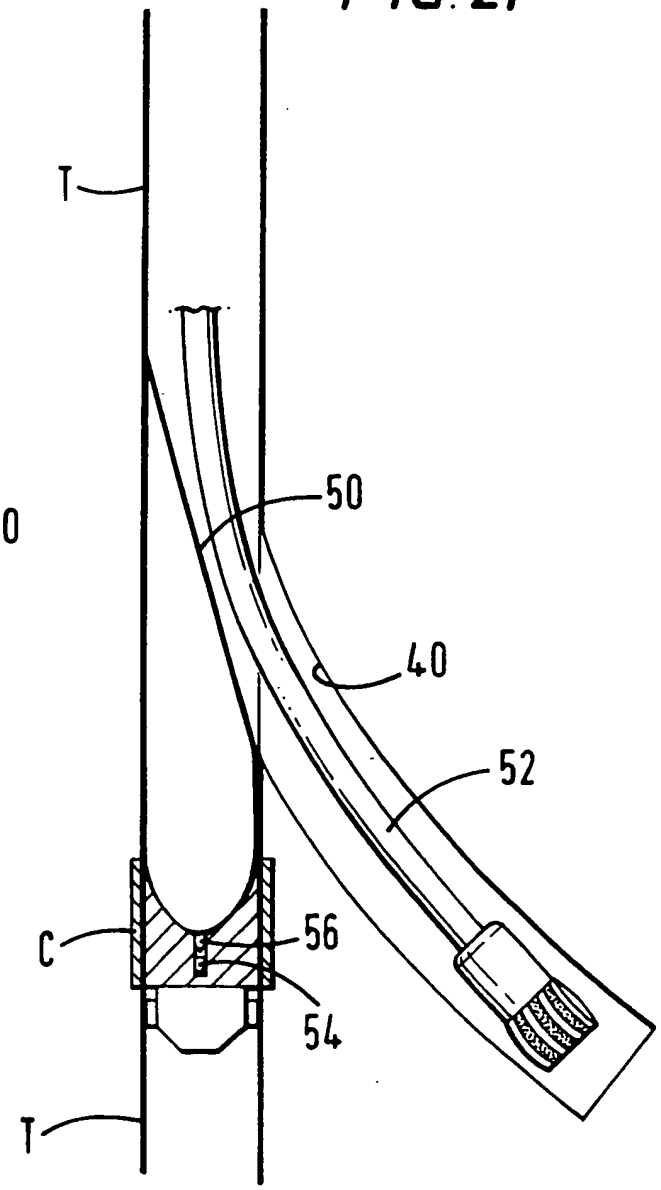
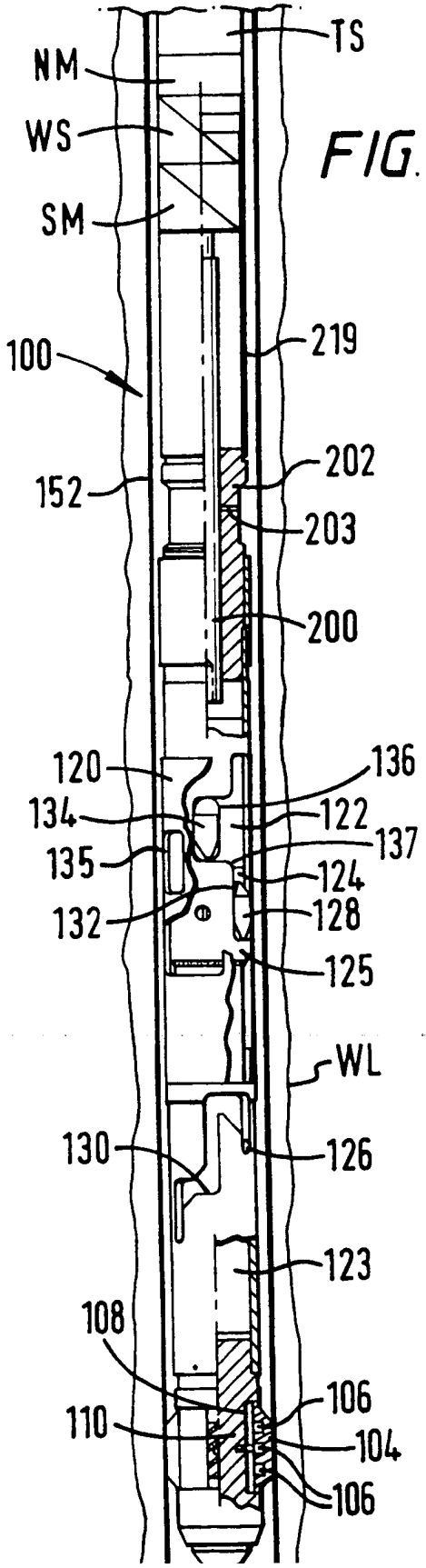


FIG. 2F

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NM
WS
SM
100
219
202
152
203
200
120
136
134
122
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124
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125
WL
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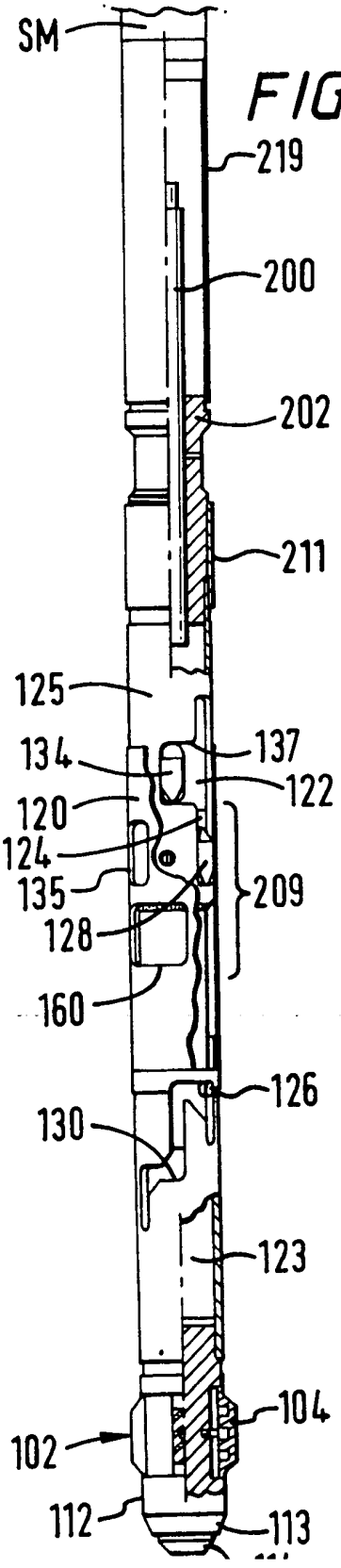
126
123
108
106
110
104
106

FIG. 3A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202
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137
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124
209
135
128
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126
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123
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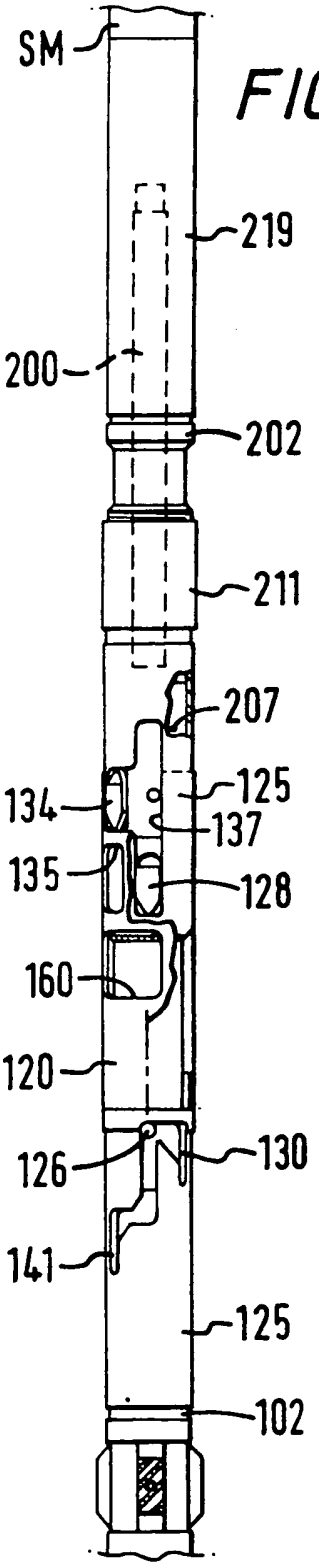
102
112
113

FIG. 3B

FIG. 3C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102

FIG. 3D

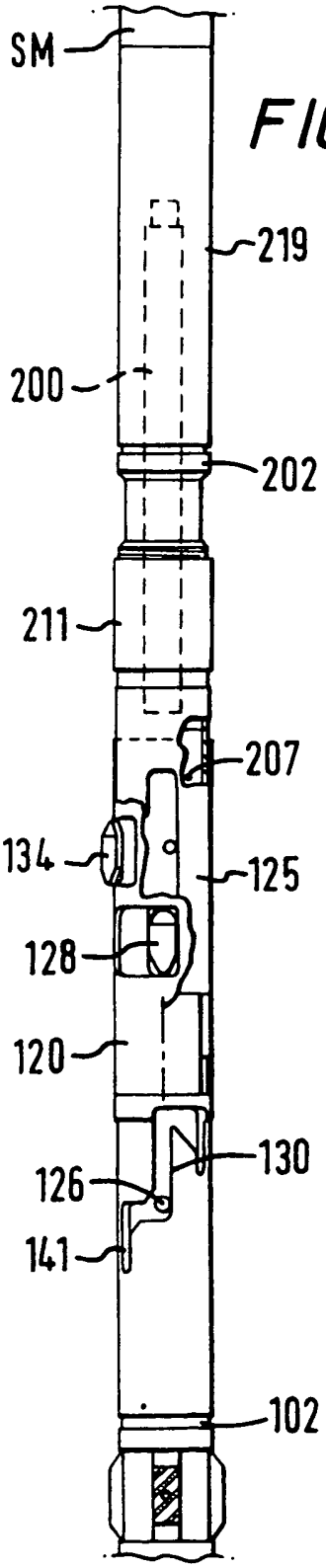
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FIG. 3E

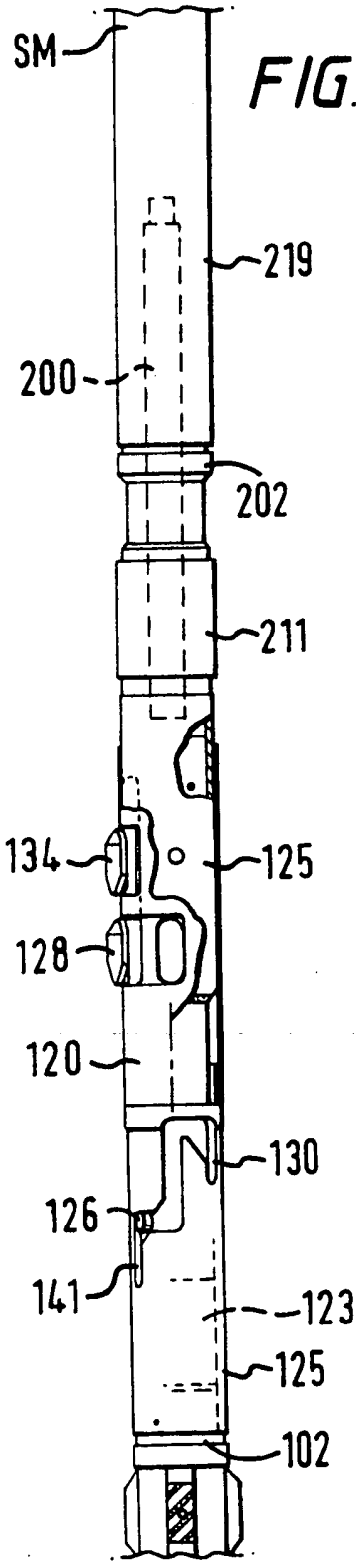
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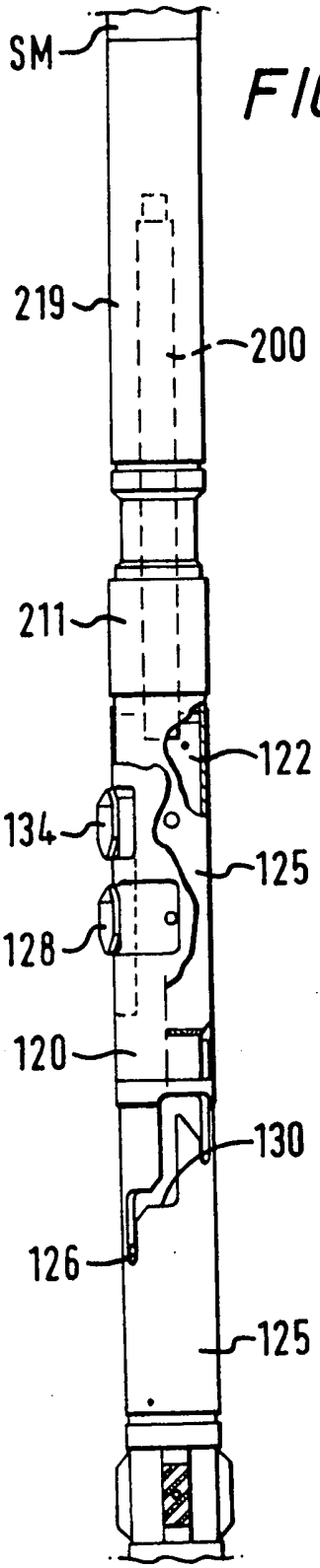
FIG. 3F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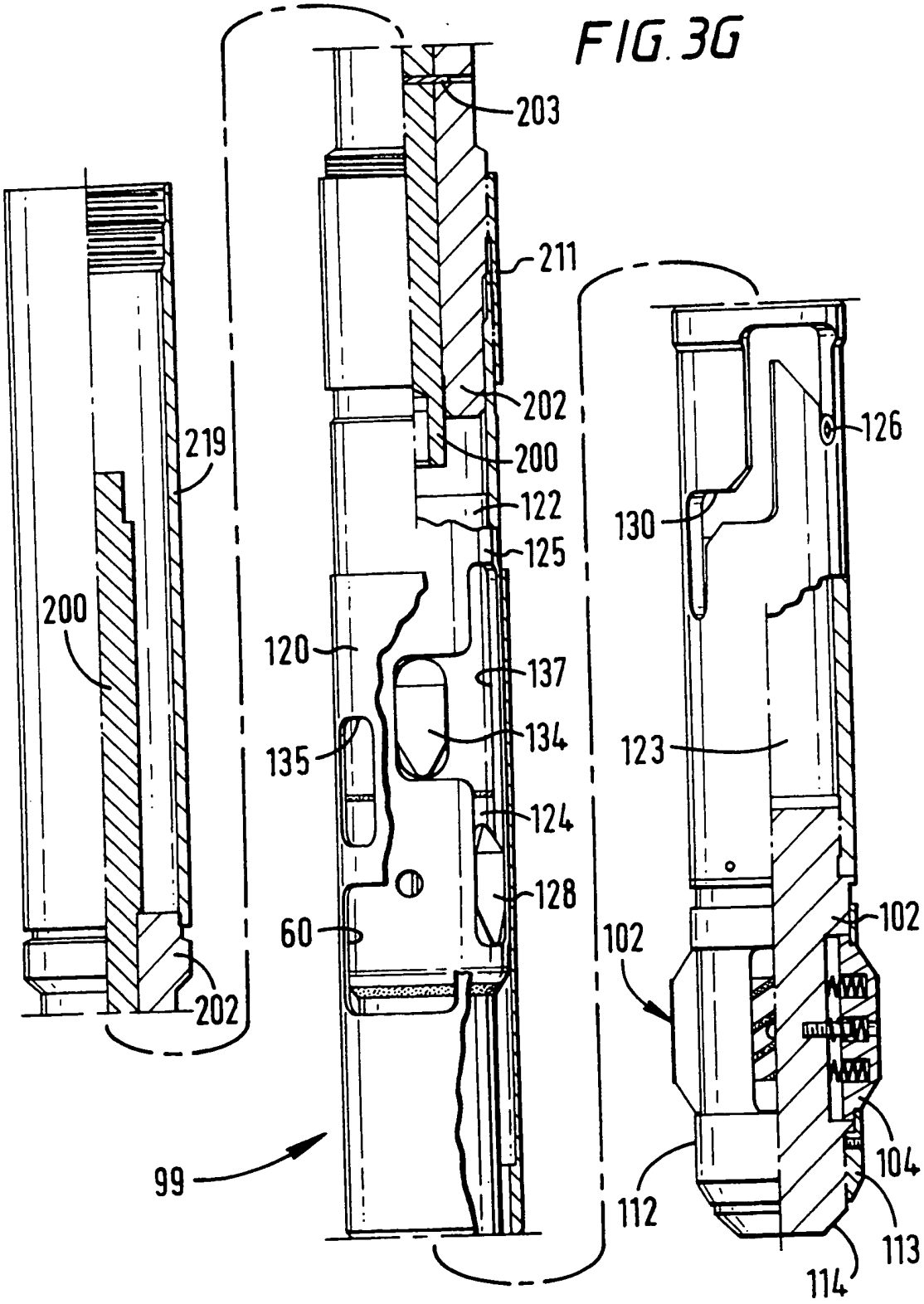
126
125

FIG. 3G


203
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202
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122
125
120
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112
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114
99

FIG. 4A

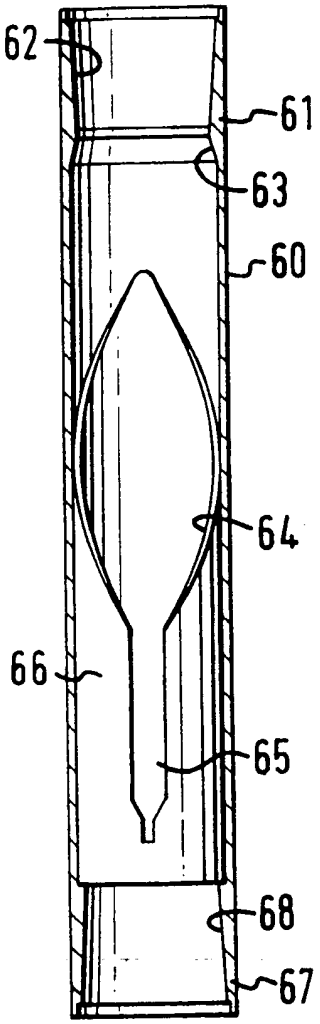


FIG. 4B

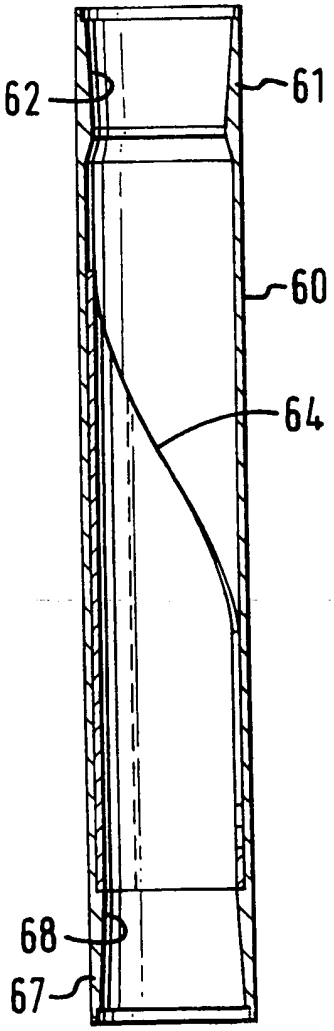


FIG. 11A

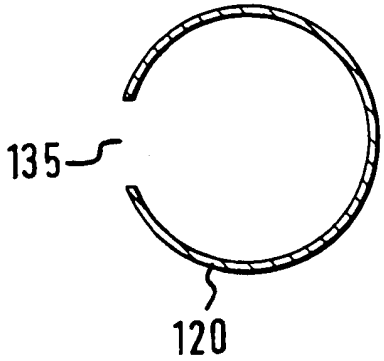


FIG. 11B

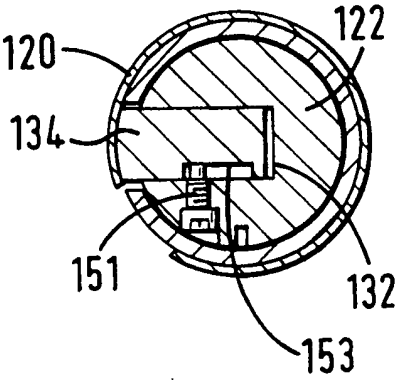


FIG. 11C

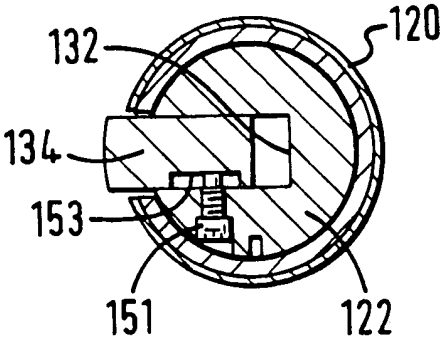
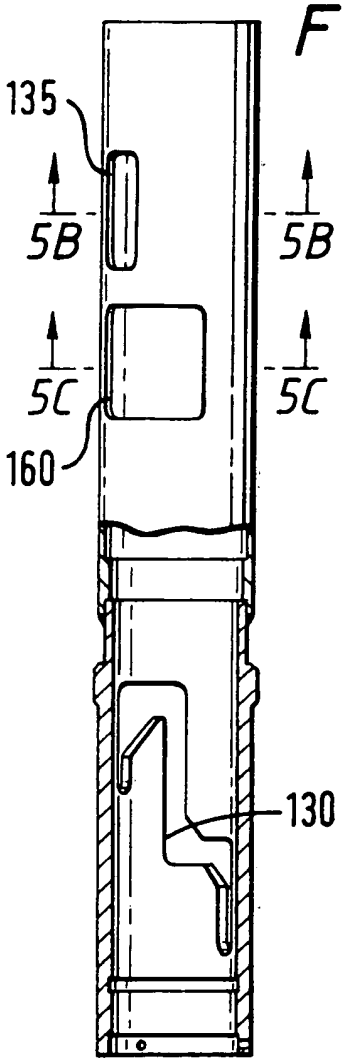


FIG. 5A



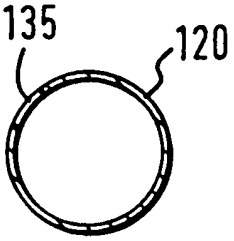


FIG. 5B

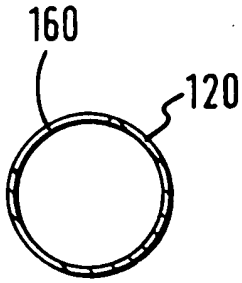


FIG. 5C

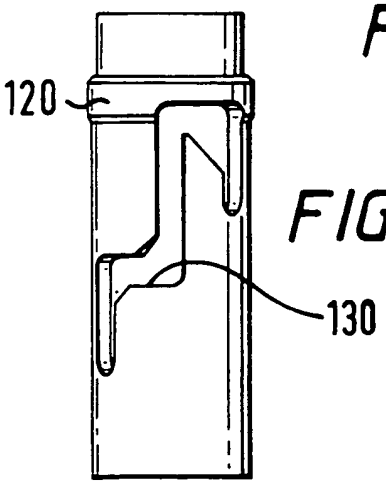


FIG. 5D

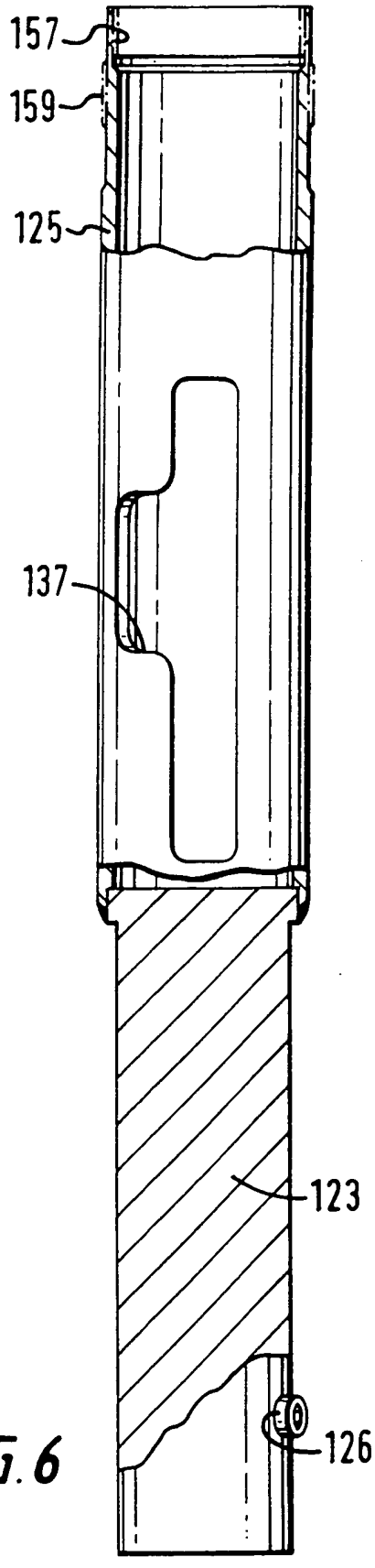


FIG. 6

FIG. 7A

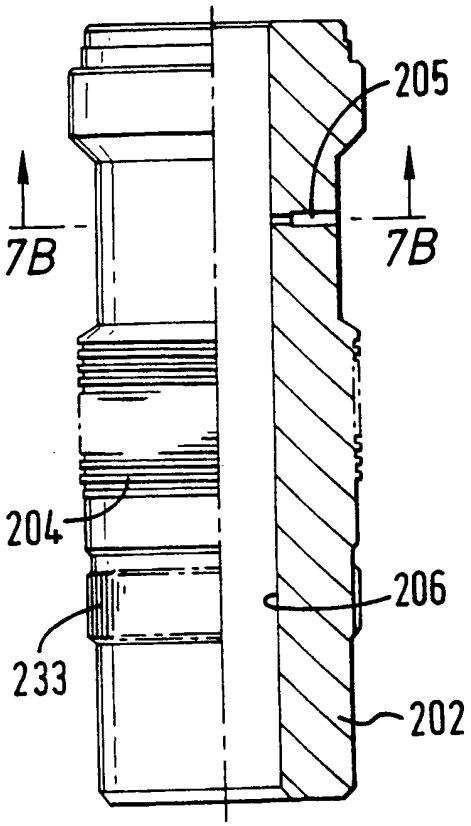


FIG. 7B

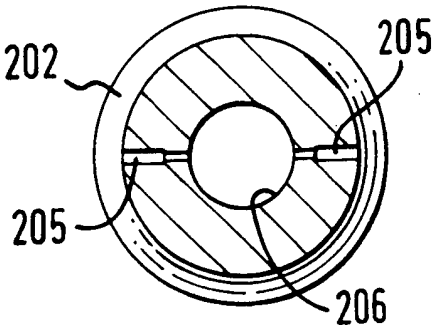


FIG. 7C

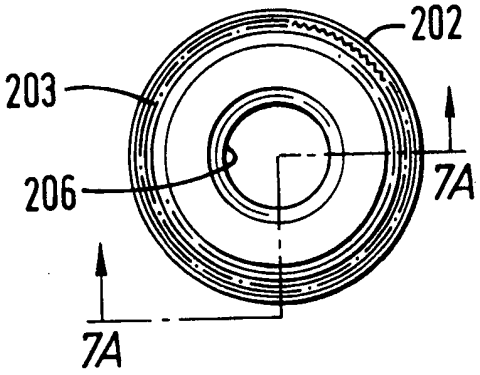


FIG. 8A

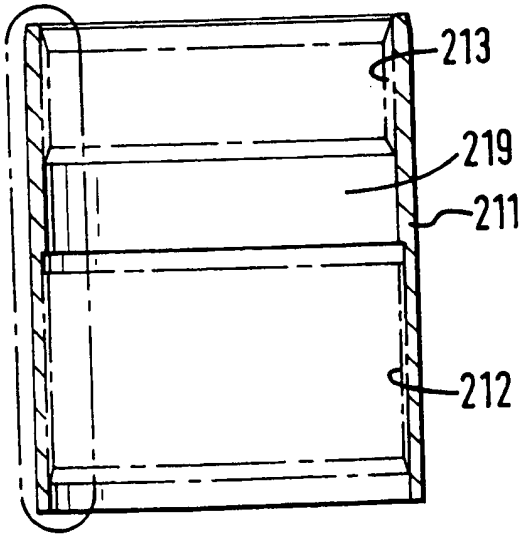


FIG. 8B

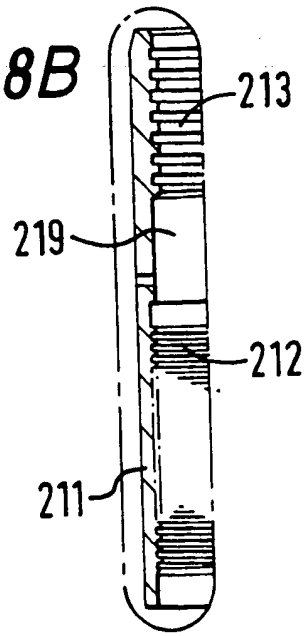


FIG. 9

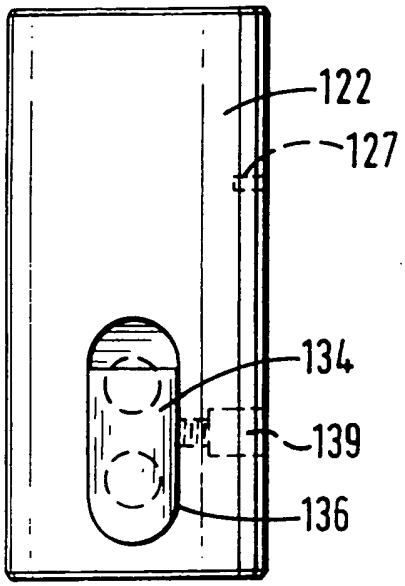
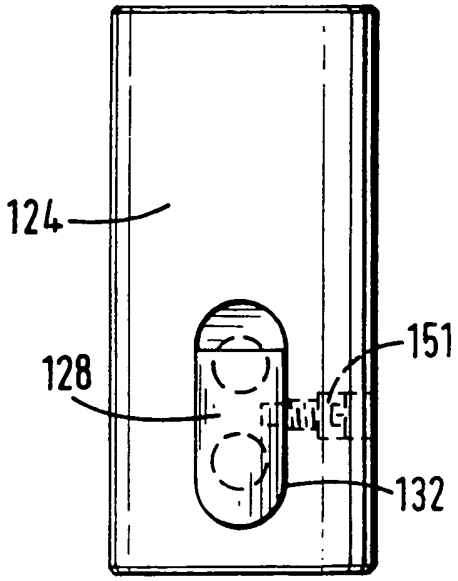


FIG. 10A



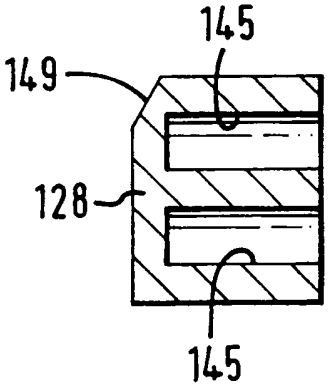
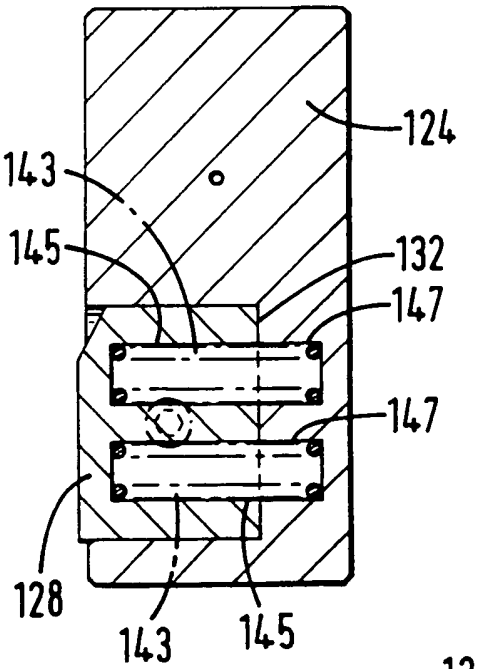


FIG. 10C

FIG. 10B



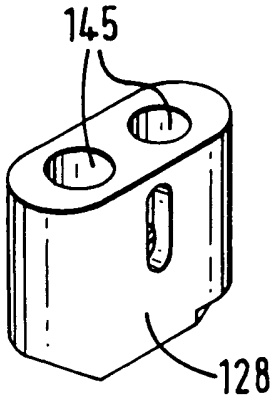


FIG. 10D

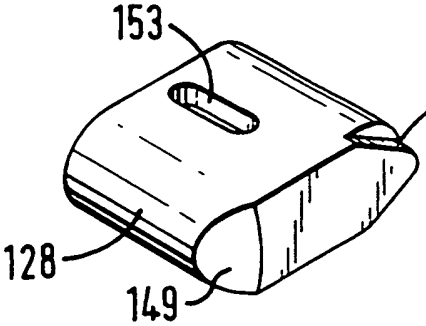


FIG. 10E

FIG. 12A

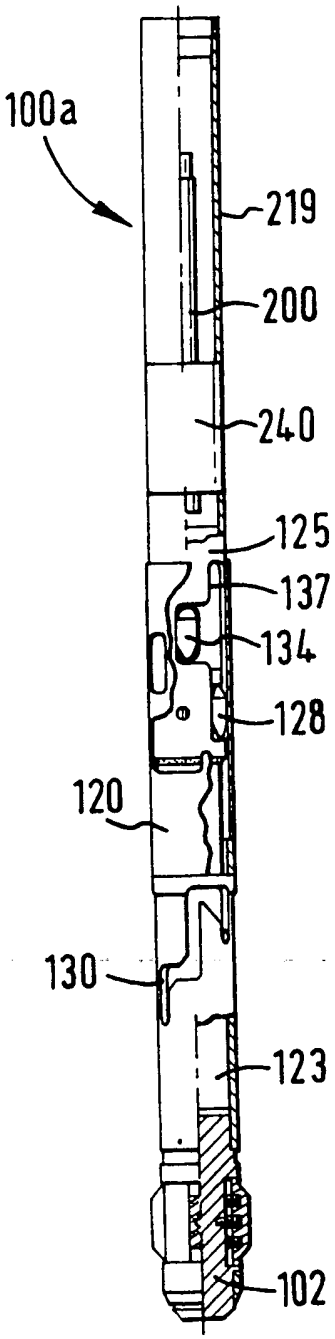
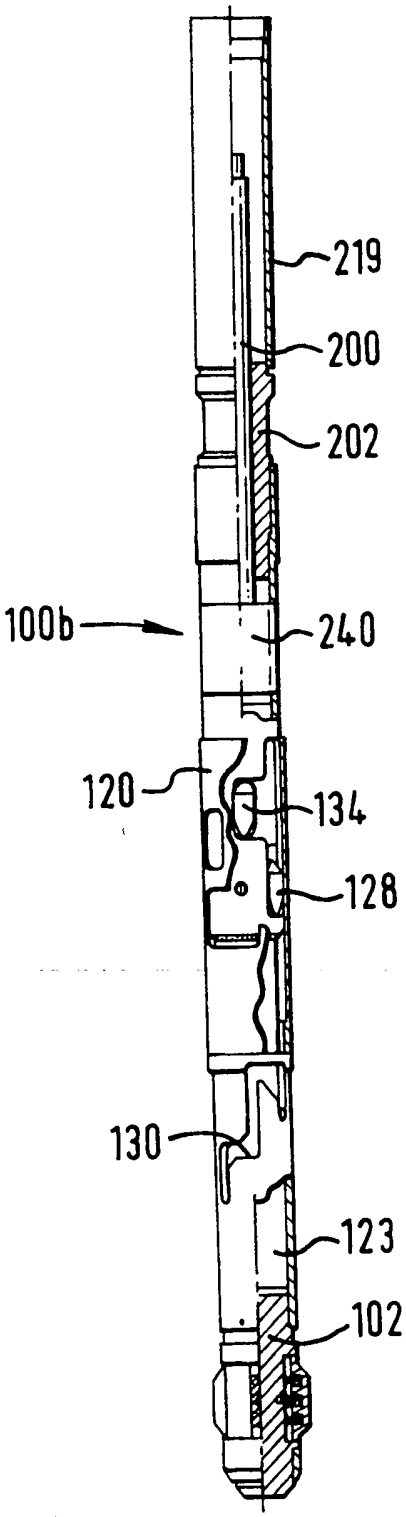


FIG. 12B



INTERNATIONAL SEARCH REPORT

Interna... il Application No
PCT/GB 99/00918

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E21B29/06 E21B23/01 E21B23/00 E21B7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category '	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 531 271 A (CARTER THURMAN B) 2 July 1996 see column 12, line 66 - column 13, line 35 see column 13, line 58 - line 62 see column 14, line 39 - column 15, line 8 see column 15, line 52 - column 16, line 7 see column 17, line 54 - column 18, line 7 see column 22, line 45 - line 53 see column 24, line 58 - column 25, line 21 see column 26, line 60 - column 27, line 35 see figures 1-5,9,16,26 see figures 528,61,72,74 see for instance tubular 12. (very general term)profile 26, key 36.concave 22. friction engaging means 316,1492.197,setting bar 514, flexible -/--	1-8,10, 11,20-31 12-19

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 July 1999	03.09.99

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.	Tompoulaglou, C

INTERNATIONAL SEARCH REPORT

Intern. ial Application No
PCT/GB 99/00918

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	member 650,slots in fig. 49.50	
X	US 5 595 247 A (BRADDICK BRITT O) 21 January 1997	1-6,9, 14,15, 24-31
A	see column 6, line 18 - line 47 see column 9, line 63 - column 10, line 19 see column 12, line 53 - line 65 see tubular C, profiles 24, 26, key 90, slot 92, setting tool WSS, shear pin 182 see figures 3,5,6,17	7,8

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internal Application No
PCT/GB 99/00918

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5531271 A	02-07-1996	US 5425417 A	20-06-1995
		US 5409060 A	25-04-1995
		US 5452759 A	26-09-1995
		US 5429187 A	04-07-1995
		AU 697695 B	15-10-1998
		AU 5157796 A	16-10-1996
		CA 2216518 A	03-10-1996
		EP 0815344 A	07-01-1998
		WO 9630622 A	03-10-1996
		NO 974287 A	10-11-1997
		US 5806595 A	15-09-1998
		US 5836387 A	17-11-1998
		AU 678529 B	29-05-1997
		AU 7618794 A	27-03-1995
		EP 0717808 A	26-06-1996
		WO 9507404 A	16-03-1995
		NO 954843 A	29-11-1995
		US 5826651 A	27-10-1998
		US 5887655 A	30-03-1999
		US 5887668 A	30-03-1995
		AU 7610794 A	09-10-1995
		CA 2181562 A	28-09-1995
		WO 9525875 A	28-09-1995
		EP 0750716 A	02-01-1997
		NO 963221 A	01-08-1996
US 5595247 A	21-01-1997	US 5566762 A	22-10-1996
		CA 2164774 A	24-09-1996
		GB 2299105 A,B	25-09-1996
		US 5678635 A	21-10-1997
		US 5647437 A	15-07-1997